

depending on radio-active change distinguish, not only heterobaric, but isobaric isotopes, and also isobaric heterotopes—that is, substances of different atomic weight and identical chemical character, of the same atomic weight and chemical character, and of the same atomic weight and different chemical character. A glance at the chart will show many examples of all three kinds. Not only has the chemical element been robbed of its time-honoured title to be considered the ultimate unchanging constituent of matter, but its title to be considered homogeneous has also vanished. The century that began with Dalton and ended with the discoveries of Becquerel and the Curies took the practical conception of the element it found extant, as that which could not be further resolved, and made of it the central conception of a theory of the ultimate constitution of matter. The element was first atomised, and then the atom and the element became synonyms, related as the singular is to the plural. Every one of the conceptions which associated the atom with the chemical element now has to be modified. Atoms of different chemical elements may have the same atomic weight; those of what the chemist and spectroscopist regard as the same element may have different atomic weight; and, most difficult to include of all to anyone to-day attempting to define the chemical element, even though the atoms all have the same weight, the element, nevertheless, may be an unresolvable mixture of fundamentally different isobaric isotopes. Present-day complete identity may conceal differences for the future of paramount importance, if ever transmutation is practically realisable at will. The goal that inspires the search for the homogeneous constituents out of which the material world is composed is now known to be, like infinity, approachable rather than attainable. The practical and necessary conception of the chemical elements, as understood before these discoveries, is, of course, unaffected. It had, and it has, a real significance as representing the limits of the spectroscopic and chemical analysis of matter, which remains, though it is now known to convey something very unlike the original and natural conception of the elements as the *l m n*'s of the material alphabet.

UNIVERSITY AND EDUCATIONAL INTELLIGENCE.

THE following candidates have been elected to represent University constituencies in the House of Commons (members of the late Parliament are distinguished by an asterisk):—*Oxford*: *Lord Hugh Cecil and *Mr. R. E. Prothero. *Cambridge*: *Mr. J. E. P. Rawlinson and *Sir Joseph Larmor. *London*: *Sir Philip Magnus. *Combined English Universities*: *Mr. H. A. L. Fisher and Sir Martin Conway. *Wales*: *Mr. J. Herbert Lewis. *Scotland*: *Sir Watson Cheyne, Mr. D. M. Cowan, and *Sir Henry Craik. *Dublin*: *Mr. A. W. Samuels and Sir Robert Woods. *National*: Mr. J. MacNeil. *Queen's (Belfast)*: Sir William Whitla.

THE National Education Association, Caxton House, Westminster, has prepared and published a useful summary of sixteen quarto pages (price 6d.) of the Education Act, 1918, in which the Act is succinctly summarised and explained. The pamphlet further contains a brief *résumé* of each of the sections of the Act, in which is included only the operative words and phrases grouped under special headings, such as the "Organisation of Education," "Co-operation and Combination," "Expenditure," "Attendance at Continuation Schools," "To Aid Research," "Central Schools and Classes," "Education Grants," etc. It will prove exceedingly helpful to members of education com-

mittees, to officials engaged in administration, and to the teaching profession, both public and private, since it gives without technical and legal verbiage a clear view of the operations of the Act, and enables them to see how very much of the Act can, even in present circumstances, be brought into immediate operation. Now that the war is practically over it may be assumed that the Board of Education, as it is empowered by the Act, will, so soon as the conditions of peace are arranged and the treaty is signed, bring into operation the vital sub-sections of the Act raising the compulsory age of attendance at public elementary schools to fourteen years in all areas, and empower local authorities to raise by by-law the age to fifteen where so desired. Already a majority of the sections of the Act is in full operation, and it only awaits the conclusion of peace for this, the most important Act of the last session of Parliament, to come into full and salutary effect.

It has been known for some time that, by reason of the general interruption of academic studies during the war, special and temporary provision would be made for the admission of men of military age into the Civil Service otherwise than by competitive examination. Announcement is now made that appointments within the scope of clause 5 of the Principal Order (the Civil Service (Consolidating) Order, January 10, 1910) may be made by selection on a competitive basis, but without competitive examination, through the agency of a selection board or boards appointed by the Treasury, and according to regulations framed, or to be from time to time framed, by the Commissioners, and approved by the Treasury. All men who have served either in his Majesty's Naval, Military, or Air Forces, or, being unfit for general service in those forces, have been employed in one or more of his Majesty's Civil Departments during the war, and are in a position to satisfy the Commissioners and the Selection Board that they are of the requisite age, health, character, and educational and other qualifications, will be eligible to compete for such appointments. It is understood that the Selection Board to be appointed by the Treasury will be charged with the work for India and the Colonies, as well as for the Home Service. It is very important that these Selection Boards shall include representatives of scientific and other modern subjects, as well as those with literary or legal interests, so as to ensure that a just proportion of the candidates appointed shall possess the training and knowledge which a progressive nation needs in its administrative officials.

IN the *Scientific Monthly* for September Prof. George Sarton has an article on "The Teaching of the History of Science," which gives further insight into his ideas on this subject. Just as a skilled workman employed day by day on the one job he can do best runs the risk of becoming a human machine, so the scientific investigator who devotes his life to one particular field of research is in danger of losing touch with reality. The workman may gain a broader outlook over the work on which he is engaged by attending evening classes at a technical institute; for the scientific investigator Prof. Sarton recommends lectures on the history of science. The lecturers on this subject would give comprehensive surveys of the whole field of science, illustrating their lectures, so far as possible, with models and simple experiments. The author considers that each university should establish three such courses:—(a) An introductory course on the history of science throughout the ages; (b) the history of a particular science; and (c) the history of science and civilisation at a special period. The two special courses would be changed from year

to year. He would admit to these courses only those who, by having worked successfully in a laboratory, would be in a position to appreciate the instruction. Prof. Sartori insists that the value of this teaching will largely depend upon the soundness of its scientific foundation. The teaching should not be entrusted to literary people, philosophers, or anyone knowing science only in a superficial way, but must be precise and concrete, its chief purpose being to interpret the scientific spirit and methods. The ultimate aim of the courses is to humanise science, and so to give it its due part in a general scheme of education.

SOCIETIES AND ACADEMIES.

LONDON.

Optical Society, December 12.—Prof. F. J. Cheshire, president, in the chair.—Instructor-Com. T. Y. Baker and Major L. N. G. Filon: An empirical formula for the longitudinal aberration of a ray through a thick lens. The authors showed that the development of the longitudinal aberration as a power series is frequently illegitimate owing to its divergence for comparatively slight inclinations of the rays. Instead of such development of the form $at^2 + bt^3 + \dots$, where t is the tangent of the inclination of the ray, they proposed a formula $At^2/(1+Bt^2)$, and determined A and B numerically from the values of the aberration of particular rays calculated trigonometrically through a lens. This was done for a whole series of image positions and for a whole series of lenses of different shapes but of the same focal length. The numerical values of A and B so obtained were then analysed, and an endeavour was made to obtain approximate general formulæ for them in terms of the image position and the lens shape. The authors decided that in all cases the value A in their empirical formula and the value a in the power series were practically identical. The value of a was given by the authors in a paper read before the society in May. The value of B can be expressed as a cubic in M, the linear magnification of the image. Thus $B = B_0 + B_1M + B_2M^2 + B_3M^3$, in which the four coefficients B_0, B_1, B_2 , and B_3 are all quadratic functions of the mean curvature of the lens faces.—Major E. O. Henrici: Spirit-levels. The best bubble tubes for spirit-levels have been made in Germany; it seems desirable that an investigation should be made of the factors necessary for producing satisfactory tubes. The advantage of a long air-bubble, as regards both the accuracy and rapidity with which the bubble comes to rest when displaced, was pointed out, and also the advantage of a short radius of curvature as regards the latter point. The radius of curvature (in other words, the sensitiveness) must, however, be sufficiently great for the bubble to move noticeably with the smallest angular tilt of the tube which it is desired to indicate. If the bubble be too sensitive, time is lost; if it be not sufficiently sensitive, a spurious idea of accuracy is given; the sensitiveness of every bubble tube for accurate work should be marked. The methods of mounting, illuminating, and viewing the bubble tube frequently leave much to be desired, and improvements in these matters lead to increased accuracy for a given sensitiveness. Several methods of viewing by means of prisms were described, the most satisfactory known to the author being one placed on the market by Zeiss. The accuracy of shaping the surface required in a sensitive bubble is very great. If a tube has a corrugated surface, the corrugations having an amplitude of $1/2000$ mm. and a period of 10 mm., the angle of tilt to move the bubble 1 mm. may vary 38 per cent. from its nominal value in the case of a bubble with a sensitiveness of 10 seconds per mm., the bubble being

35 mm. long. A similar corrugation with a 2-second bubble will make it almost useless for any purpose. Further investigation is required into the effect of the following factors on the performance of the bubble:—Quality, polish, and cleanliness of the glass; quality and purity of the liquid and vapour in the tube, and the best methods of mounting and viewing.

Aristotelian Society, December 16.—Prof. Wildon Carr, vice-president, in the chair.—Prof. J. Laird: Synthesis and discovery in knowledge. The paper consisted of a discussion of two sharply contrasted views of knowledge (viz. that knowledge is essentially the inspection or the discovery of an object which is given or revealed, and that knowledge is essentially a process of organisation or construction on the part of the mind), together with a consideration of certain hypotheses designed to mediate between these extreme views. The general argument was that while the first of these alternatives could be defended against many of the objections commonly brought against it, it was ultimately inadequate, since representative construction in words, images, etc., is plainly an integral part of most varieties of knowing. An examination of the theory that knowledge is always the inspection of a construction showed (1) that in this case the product of construction required to be apprehended directly, and (2) that such a product could be known to be representative only if the things represented were directly apprehended, in some instances at least. The theory that knowledge consists of construction (it was claimed) was therefore refuted, and the rest of the argument consisted of a detailed investigation into the truth of the statements that the object of knowledge is always (in some sense) a mental product on the ground that this object is always "a unity" or "a meaning," or that mental imagery is always an essential part of it. The author maintained that these arguments were either fallacious or inconclusive.

PARIS.

Academy of Sciences, December 9, 1918.—M. P. Painlevé in the chair.—E. Picard and A. Lacroix: The second meeting of the Inter-Allied Conference of Scientific Academies. An account of the resolutions passed at the meeting held at Paris, November 26 to 29 (see NATURE, December 26, 1918, p. 325).—J. Drach: Integration of a partial differential equation of the dynamics of fluids.—A. Buhl: The extension to multiple integrals of the theorem concerning the exchange of the amplitude and parameter in hyper-elliptic integrals.—A. Lambert: Certain polynomials connected with Laplace coefficients.—Ch. Frémont: A new machine for measuring the resistance of cast-iron by the method of chiselling.—Ch. Gorceix: The probable correlation of the displacements of level of the base and the oscillations of glacial fronts.—A. Guébbard: A possible conciliation between the two theories of volcanic action.—M. Molliard: The saprophytic life of an Entomophthora. This fungus (*E. henrici*), developed originally on a *Culex pipiens*, has been grown successfully on the sterilised grub of *Euchelia jacobaeae*, on sterilised ox-liver, and even on carrot, but in the last-named the cultures are not so abundant as on liver. Hence this species is not necessarily parasitic.—F.-X. Skupienski: Sexuality in *Dictyostelium mucoroides*.—L. Roule: The state of spawning salmon during their migration into fresh water in France. From the examination of eighty fish taken at different periods it is concluded that for the first two years young salmon live in fresh water, and then descend to the sea, growing there for a period varying from two to four years. Then, at the age of between four and six years, they return to